FREEHOLD REGIONAL HIGH SCHOOL DISTRICT
OFFICE OF CURRICULUM AND INSTRUCTION
International Baccalaureate Program

IB DESIGN TECHNOLOGY SL & HL YEAR 2

Grade Level: 12

Credits: 5

BOARD OF EDUCATION ADOPTION DATE: AUGUST 27, 2025

FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

Board of Education

Mr. Pete Bruno, President
Mr. Michael Messinger, Vice President
Mr. Carl Accettola
Mrs. Jamie Bruno
Ms. Joan Butcher-Farkas
Ms. Diana Cappiello
Mrs. Liz Higley
Mrs. Kathie Lavin
Ms. Amanda McCobb

Central Administration

Dr. Nicole Hazel, Superintendent
Dr. Shanna Howell, Chief Academic Officer
Dr. Oscar Diaz, Administrative Supervisor of Curriculum & Instruction
Ms. Stephanie Mechmann, Administrative Supervisor of Curriculum & Instruction
Ms. Jennifer Okerson, Administrative Supervisor of Curriculum & Instruction
Mr. Brian Simpson, Administrative Supervisor of Curriculum & Instruction

Curriculum Writing Committee

Ms. Jennifer Heir
Ms. Megan Herbert

Supervisors

Ms. Kristine Jenner
Ms. Brittany Vitale

IB Design Technology SL & HL Year 2

Course Description

From the International Baccalaureate: "*Design Technology* aims to develop internationally minded people whose enhanced understanding of design and the technological world can facilitate our shared guardianship of the planet and create a better world. The course focuses on analysis, design development, synthesis and evaluation. The creative tension between theory and practice is what characterizes design technology within the DP sciences group. *Design Technology* achieves a high level of design literacy by enabling students to develop critical- thinking and design skills that they can apply in a practical context. While designing may take various forms, it will involve the selective application of knowledge within an ethical framework. A well-planned design technology course enables students to develop not only practical skills but also strategies for creative and critical thinking. The course draws on a wide spectrum of knowledge, enables and empowers innovation, exploration and the acquisition of further knowledge, actively promotes the act of learning by experience through topics designed for practical exploration, raises ethical issues in design, and is underpinned by design thinking. During the course, students will develop a product design solution. This will involve the ability to identify a problem or need; design, model, test and develop a product design solution (performance testing); and liaise with clients, target audiences and end-users to evaluate the success of the product design solution (user testing).

Course Sequence and Pacing

Unit Title	Unit Sections	Suggested Pacing
Unit 6: Criterion C: Ideation and Modelling	Section 6.1 Safety and Rules Section 6.2 Empathize and Define the Project	4 Sessions
Unit 7: Design for Manufacture (HL only)	Section 7.1 Design for Manufacture (HL only)	6 Sessions
Unit 8: Internal Assessment: The Design Project	Section 8.1 Criterion C: Identifying Redesign Ideas Section 8.2 Criterion D: Fidelity Models Testing and Refinement | Designing a Solution	22 Sessions
Unit 9: Structural Systems (HL only)	Section 9.1 Design in Theory: Introduction to Structural Systems (HL only) Section 9.2: Design in Practice: Structural Systems Application and Selection (HL only)	14 Sessions
Unit 10: Production Systems (HL only)	Section 10.1 Design in Practice: Production Systems (HL only) Section 10.2 : Design in Context: Life-Cycle Analysis (HL only)	14 Sessions
Unit 11: Internal Assessment: The Design Project	Section 11.1 Criterion E: Presenting a Solution	5 Sessions
Unit 12: IA Review / Final IAs	Section 12.1 IA Review	3 Sessions
Unit 13: Mechanical and Electrical Systems (HL Only)	Section 13.1 : Product: Introduction to Mechanical Systems (HL only) Section 13.2 : Design in Practice: Mechanical Systems Application and Selection (HL only) Section 13.3 : Design in Theory: Introduction to Electrical Systems (HL only) Section 13.4 : Design in Practice: Electronic Systems Application and Selection (HL only)	26 Sessions
Unit 14: Review for Exams	Section 14.1 Review	9 Sessions

Support Resources

Supporting resources and appendices for this curriculum are available. These include a Resource Catalog of standards-aligned activities, common formative assessment and interdisciplinary items for performance expectations and objectives in this course.

- Appendix A: Accommodations and Modifications for Various Student Populations
- Appendix B: Assessment Evidence
- Appendix C: Interdisciplinary Connections

IB Design Technology SL & HL Year 2 **Unit 6: Criterion C: Ideation and Modelling** **Section 6.1 Safety and Rules**	**Suggested Pacing: 2 sessions**
Standards-Aligned-Daily Objectives. Instruction and assessment will align to the following objectives:	
6.1 [1] Identify and describe general safety rules applicable to all hand tools (e.g., clear workspace, proper lighting, wearing safety glasses	
6.1 [2] Distinguish between tools and materials for proper usage and storage.	
6.1 [3] Identify and select the correct tool for a specific task, understanding the application of the tool.	
6.1 [4] Demonstrate the safe and proper handling of hand tools, including carrying, passing, and storing them correctly.	
6.1 [5] Understand and adhere to the "no horseplay" rule and explain why it is critical for safety in a workshop setting	
6.1 [6] Differentiate between appropriate and inappropriate materials for cutting with specific tools in the classroom.	
6.1 [7] Identify the heating element and nozzle of a hot glue gun / wire cutters and understand that these are the hottest parts.	

IB Design Technology Year 2 **Unit 6: Criterion C: Ideation and Modelling** **Section 6.2 Empathize and Define the Project**	**Suggested Pacing: 2 sessions**
IB Assessment Objectives	
C3.1 How does product analysis and evaluation inform various stakeholders and aid in a product's future development?	
A2.1 How do designers understand the relationship between users, the product and the environment?	
Standards-Aligned-Daily Objectives. Instruction and assessment will align to the following objectives:	
6.2 [1] **Analyse** a product using a SWOT analysis based on function, performance, usability, features and materials. *C.3.1.3 A SWOT analysis is a standard product analysis tool that is used to identify a product's strengths, weaknesses, opportunities and threats.*	
6.2 [1] **Explain** how user-centred research methods (field research, task analysis, user observation, interviews, surveys and focus groups) can be used to discover the true nature of a user population. *A.2.1.4 User-centred research methods can be used to understand a user population(s).*	
Review and Finalize Criterion A (analysis of primary persona, presentation of storyboard, analysis of range of existing products) and Criterion B (problem statement, product design specification)	

IB Design Technology Year 2 **Unit 7: Design for Manufacture (HL only)** **Section 7.1 Design for Manufacture (HL only)**	**Suggested Pacing: 6 sessions**
IB Assessment Objectives	
C4.1.How can the evolution of production systems transform the way products are designed and manufactured, and transform the efficient disposal of products?	
Standards-Aligned-Daily Objectives. Instruction and assessment will align to the following objectives:	
7.1 [1] **Outline** design for process, design for assembly and design for disassembly strategies. *C.4.1.1 Design for manufacture (DfM) comprises of three strategies.*	
7.1 [2] **Outline** the advantages of design for process and explain how a product could be designed using this strategy. *C.4.1.2 Design for process considers how products are made using a specific manufacturing technique.*	
7.1 [3] **Outline** the advantages of design for assembly and explain how a product could be designed using the design for assembly strategy. *C.4.1.3 Design for assembly considers how components of a product are combined.*	
7.1 [4] **Outline** the advantages of design for disassembly and explain how a product could be designed using this strategy. *C.4.1.4 Design for disassembly considers how components of a product can be separated.*	
7.1 [5] Discuss how designers use DfM strategies to reduce the environmental impact of the manufacture, use and disposal of products. *C.4.1.5 The selection of DfM strategies has a direct effect on the environmental impact of the manufacture, use and disposal of a product.*	
Suggested assessment: Analyze an existing product to evaluate its design for manufacture strategies	

IB Design Technology Year 2 **Unit 8: Internal assessment: The Design Project** **Section 8.1 Criterion C: Identifying Redesign Ideas**	**Suggested Pacing: 12 sessions**
IB Assessment Objectives	
A2.2 Why is it necessary for designers to prototype ideas as part of a design process?	
B2.1 How do designers approach problem-solving?	
B2.2 How do designers communicate ideas to different stakeholders?	
Standards-Aligned-Daily Objectives. Instruction and assessment will align to the following objectives:	
8.1 [1] **Explain** the advantages and disadvantages of using low- and high-fidelity prototyping within a design process. *A.2.2.1 There are two techniques used in iterative design and development: low fidelity and high fidelity.*	
8.1 [2] **Apply** ideation techniques to develop a range of diverse and appropriate ideas that address a problem statement and respond to design specifications. *B.2.1.10 The ideation and modelling stage involves developing distinct ways to solve a particular problem that demonstrate different approaches to develop a solution.*	
8.1 [3] Compare their ideas with the design specifications and user needs as they refine their solutions. *B.2.1.11 Iterative analyses and evaluation of design ideas lead to improved design ideas.*	
8.1 [4] **Demonstrate** iterative development of a design using the model, test, refine cycle. *B.2.1.12 When developing a solution, designers use an iterative model, test, refine cycle until all major design specifications and user requirements are satisfied.*	
8.1 [5] Create feasible models of an intended solution at appropriate levels of fidelity that generate performance data when tested with end-users. *B.2.1.13 Models, prototypes and mockups of solutions are created to test their effectiveness and to gather feedback for further refinement and development.*	
8.1 [6] Create feasible models of an intended solution at appropriate levels of fidelity that generate performance data when tested with end-users. *B.2.1.13 Models, prototypes and mockups of solutions are created to test their effectiveness and to gather feedback for further refinement and development.*	
8.1 [7] **Construct** and interpret 2D drawings and 3D models, including isometric, orthographic projection, assembly and exploded drawings. *B.2.2.1 Drawings facilitate the discussion of concepts to others for feedback or information.*	
8.1 [8] **Construct** and interpret aesthetic and functional prototypes at different levels of fidelity, including the considerations of scale, shape and space. *B.2.2.2 Physical prototypes are 3D, tangible representations of design or systems and can be developed at a range of fidelity for different users and environments.*	
8.1 [9] **Construct** and interpret surface, solid and virtual models. *B.2.2.3 Computer-aided design (CAD) involves the creation, development and analysis of a design outcome using computer software.*	
8.1 [10] Select and use appropriate drawings, physical prototypes and CAD models to gather relevant data and feedback, which can be used to **analyse** and develop the design iteratively. *B.2.2.6 Prototypes are created to gather data and feedback from potential users and clients.*	
Criterion C, 1-2: preset feasible redesign ideas, identify redesign ideas	

IB Design Technology Year 2 **Suggested Pacing: 10 sessions** **Unit 8: Internal assessment: The Design Project** **Section 8.2 Criterion D: Fidelity Models Testing and Refinement | Designing a Solution**
IB Assessment Objectives
A2.2 Why is it necessary for designers to prototype ideas as part of a design process?
B2.1 How do designers approach problem-solving?
Standards-Aligned-Daily Objectives. Instruction and assessment will align to the following objectives:
8.2 [1] **Explain** the advantages and disadvantages of using low- and high-fidelity prototyping within a design process. *A.2.2.1 There are two techniques used in iterative design and development: low fidelity and high fidelity.*
8.2 [2] Create detailed drawings of components and assembled products that communicate dimensions, scale and assembly details. *B.2.1.14 The physical details of a new product need to be communicated for it to be manufactured.*
Criterion D, 1-2: develop fidelity models, design drawings of the intended solution

IB Design Technology Year 2 **Suggested Pacing: 6 sessions** **Unit 9: Structural Systems (HL only)** **Section 9.1 Design in Theory: Introduction to Structural Systems (HL only)**
IB Assessment Objectives
A3.2 How are structures present in everyday products?
Standards-Aligned-Daily Objectives. Instruction and assessment will align to the following objectives:
9.1 [1] **Analyse** and interpret a variety of human-made and natural structures. *A.3.2.1 Structures are ubiquitous in nature and the built environment.*
9.1 [2] Discuss frame, shell and solid structures, and how they are used in the design of products. *A.3.2.2 Structures can be classified in different ways.*
9.1 [3] **Identify** simply supported beams, fixed beams, cantilever beams, continuously supported beams, and columns, and explain their function. *A.3.2.3 Structures are often comprised of multiple parts.*
9.1 [4] **Explain** how compression, tension, torsion, bending and shear forces act within a structure, and differentiate between static and dynamic forces. *A.3.2.4 Static and dynamic forces can be identified according to how they act on a structure.*
9.1 [5] **Describe** the relationship between stress and strain on a material under stress, and be able to outline Young's Modulus, yield strength, ultimate strength and fracture in the context of a stress-strain graph. *A.3.2.5 In structures, it is important to know how and when an object or material will stretch, bend or break.*
9.1 [6] Compare materials with a high Young's Modulus and those with a low Young's Modulus in terms of how they react when placed under stress, and **explain** why this is important when designing structures. *A.3.2.6 Materials with differing Young's Modulus are chosen for specific applications.*
9.1 [7] **Describe** when a structure is in equilibrium and identify the conditions where a structure will fail (not in equilibrium). *A.3.2.7 When forces on a structure are in equilibrium, the structure is stable.*
9.1 [8] **Explain** how structures can be strengthened by using struts, shape, lamination and composite materials. *A.3.2.8 The overall design of a structure can be improved by applying strengthening techniques.*
9.1 [9] Define an SF as a ratio of a structure's absolute strength to the allowable load, and **explain** why structures are designed to include an SF. *A.3.2.9 Structures are typically designed with a safety factor (SF) in case of overloading.*
9.1 [10] **Outline** what an SF of 1 means for a structure, and explain why most structures have an SF above 1. *A.3.2.10 Structures are typically designed to withstand higher loads than required.*

IB Design Technology Year 2 **Unit 9: Structural Systems (HL only)** **Section 9.2: Design in Practice: Structural Systems Application and Selection (HL only)**	**Suggested Pacing: 8 sessions**
IB Assessment Objectives	
B3.2 How can structural systems be incorporated into product design?	
Standards-Aligned-Daily Objectives. Instruction and assessment will align to the following objectives:	
9.2 [1] **Analyse** and model the forces acting on and within the structure of existing products and be able to suggest how existing structures can be strengthened. *B.3.2.1 Structures are present in the design of everyday products.*	
9.2 [2] Apply Young's Modulus using the formula: Young's Modulus (E) = Tensile Stress (σ)/Tensile Strain (ε), and interpret stress-strain graphs for a given material, **identifying** the Young's Modulus, yield strength, ultimate strength and fracture. *B.3.B.2.2 Young's Modulus is the measure of stiffness of a material.*	
9.2 [3] **Identify** why a structure has failed, including interpreting data from finite element analysis (FEA). *B.3.2.3 Structures fail due to overloading, material choice, size and shape.*	
9.2 [4] Interpret simple force diagrams for a given structure. *B.3.2.4 Forces acting on a structure or within a beam can be represented diagrammatically.*	
9.2 [5] **Apply** SFs using the formula: SF = Ultimate Load (Stress)/Allowable Load (Stress); calculate maximum intended loads for given structures; and design structures with an SF. *B.3.2.5 Safety factors (SFs) are a way to design in contingency to prevent failure from overloading a structure.*	
Suggested assessment: Create balsa wood bridge and test	

IB Design Technology Year 2 **Unit 10: Production Systems (HL only)** **Section 10.1 Design in Practice: Production Systems (HL only)**	**Suggested Pacing: 7 sessions**
IB Assessment Objectives	
B4.1 How is the ideal production system determined for a product?	
Standards-Aligned-Daily Objectives. Instruction and assessment will align to the following objectives:	
10.1 [1] **Identify** the most effective type of production system (craft, mechanized, automated, assembly line, hybrid production systems and computer integrated manufacturing (CIM)) used in the manufacture of a given product. *B.4.1.1 Production systems can be unique and specific to the type of product being manufactured.*	
10.1 [2] **Identify** the advantages and disadvantages of each production system, including craft production, mechanization, automation, assembly line, hybrid production systems and CIM. *B.4.1.2 Production systems can be categorized based on the balance between the manufacturer and the tools and machinery they use.*	
10.1 [3] **Identify** appropriate manufacturing techniques for each scale of production, including one-off production, batch production, mass production, mass customization and continuous production. *B.4.1.3 Production systems are selected according to the required scale of production.*	
10.1 [4] Discuss factors that influence choices of manufacturing techniques, including type of product (part) being manufactured, type of material(s) used in production, scale of production, production system, cost constraints and environmental considerations. Students must be able to **justify** the selection of appropriate manufacturing techniques for the production of a product. *B.4.1.4 Various factors influence the choice of manufacturing techniques.*	
10.1 [5] Deconstruct and **analyse** multi-component products to determine how they were made and their relevance within the assembly and function of a product. *B.4.1.5 The design of a production system requires an understanding of a product, its component parts and the manufacturing techniques used.*	
10.1 [6] **Explain** how production methods can influence the function and aesthetics of a product. *B.4.1.6 The design of a product is influenced by the limitations of a production system and manufacturing techniques.*	
Suggested assessment: Evaluate Package Design for Production Systems Analyze the production of an existing multi-component product	

IB Design Technology Year 2 **Unit 10: Production Systems (HL only)** **Section 10.2 : Design in Context: Life-Cycle Analysis (HL only)**	**Suggested Pacing: 7 sessions**
IB Assessment Objectives	
C3.2 Why should designers consider the effects a product has on the environment?	
Standards-Aligned-Daily Objectives. Instruction and assessment will align to the following objectives:	
10.2 [1] **Explain** and discuss life-cycle analysis considerations, such as global warming potential, air, water and soil pollution, ecotoxicity and resource depletion, that cause environmental impact. *C.3.2.1 A life-cycle analysis (also known as the five stages of life-cycle analysis) helps designers factually analyse a product's entire life cycle in terms of sustainability.*	
10.2 [2] **Explain** the life-cycle analysis inventory stages (cradle-to-grave) and the materials and energy usage that go into these processes: raw material extraction; manufacture; distribution and transport; use and maintenance; and disposal and recycling. *C.3.2.2 Designers evaluate the environmental impacts of a product or service. In the case of a product, the environmental impact is assessed from raw material extraction and processing (cradle), through the manufacture, distribution and use, to the recycling or final disposal of the materials (grave).*	
Suggested assessment: Evaluate a real-world consumer product and perform a life-cycle analysis (LCA)	

IB Design Technology Year 2 **Unit 11: Internal assessment: The Design Project** **Section 11.1 Criterion E: Presenting a Solution**	**Suggested Pacing: 5 sessions**
IB Assessment Objectives	
B2.1 How do designers approach problem-solving?	
Standards-Aligned-Daily Objectives. Instruction and assessment will align to the following objectives:	
11.1 [1] Create virtual representations of a solution, highlighting key usability features, and **explain** how it meets the design specifications and achieves the design intentions as a proposed solution or as an improvement to an existing product. *B.2.1.15 When presenting a solution, it is important to communicate clearly the need for the solution, and the key features that demonstrate how it solves a given problem.*	
Criterion E, 1-2: present intended redesign solution, present how intended redesign solution improves on the existing product	

IB Design Technology Year 2 **Unit 12: IA Review / Final IAs**	**Suggested Pacing: 3 sessions**
IB Assessment Objectives	
AO4 Demonstrate the application of skills necessary to carry out insightful and ethical investigations	
Standards-Aligned-Daily Objectives. Instruction and assessment will align to the following objectives:	
12 [1] **Evaluate** extent to which the primary persona is clearly defined, well-supported by research (even if synthesized), and consistently applied throughout the redesign rationale.	
12 [2] **Evaluate** extent to which the student identified problems and proposed redesign solutions directly address the specific needs, pain points, and goals of the primary persona.	
12 [3] **Evaluate** extent to which the design decisions (features, interface elements, user flows) are explicitly justified by referencing the primary persona's characteristics and requirements.	
12 [4] **Evaluate** extent to which the proposed redesign, informed by the primary persona, is likely to improve the user experience for the target user.	
12 [5] **Evaluate** extent to which the overall consistency of the design choices with the defined persona's attributes, ensuring a cohesive and user-centric approach	
Criterion A-E: Empathize, defining the project, ideation and modeling, designing a solution, presenting a solution	

IB Design Technology Year 2 **Suggested Pacing: 6 sessions**
Unit 13: Mechanical and Electrical Systems (HL Only)
Section 13.1 : Product: Introduction to Mechanical Systems (HL only)

IB Assessment Objectives

A3.3 How are mechanisms present in everyday products?

Standards-Aligned-Daily Objectives. Instruction and assessment will align to the following objectives:

13.1 [1] **Identify** the four basic types of mechanical motion: linear; rotary; oscillating; and reciprocating.
A.3.3.1 There are four types of motion involved in mechanical systems.

13.1 [2] **Describe** inputs, processes and outputs in the context of mechanical systems.
A.3.3.2 Mechanical systems convert an input into an output.

13.1 [3] **Outline** a mechanical advantage and suggest how simple mechanical systems may improve performance in terms of function and efficiency.
A.3.3.3 Mechanical systems can provide a mechanical advantage to the user.

13.1 [4] **Identify** gear-driven, belt-driven, cam, lever and linkage systems.
A.3.3.4 Mechanical systems are used to increase or decrease the speed, direction or power of a motion.

13.1 [5] **Explain** the basic principles of mechanical motion and discuss how gears, pulleys, cams, levers and linkages can be combined to create complex mechanical systems.
A.3.3.5 The four types of motion can be combined to create simple or complex mechanical systems.

13.1 [6] **Identify** the different types of gear systems (spur, bevel, rack and pinion, worm, ratchet and pawl, idler and compound) and their components, and outline how they are used providing examples.
A.3.3.6 Gears transmit rotary motion from one gear shaft to another, and have a number of teeth.

13.1 [7] **Identify** components of pulley systems, and outline how they are used providing examples.
A.3.3.7 Belt-driven systems are driven by pulleys.

13.1 [8] **Identify** different shaped cams (pear, circular, triangular, eccentric, oval and snail) and outline how they are used providing examples.
A.3.3.8 The shape of a cam dictates the type of motion.

13.1 [9] **Identify** the three types of levers (1st class, 2nd class and 3rd class) and the position of the Load (L), Effort (E) and the Fulcrum, and outline how they are used providing examples.
A.3.3.9 Levers comprise a beam acting on a fulcrum (pivot) and are classed based on the relative position of the fulcrum to an applied load and effort.

13.1 [10] **Identify** parallel, reverse and bell crank linkages, and outline how they are used providing examples.
A.3.3.10 Linkages are used to change the direction of a movement, alter the magnitude of a force or make parts of a system move in a particular way.

Suggested assessment: Automata, K'Nex Car

IB Design Technology Year 2 **Suggested Pacing: 8 sessions** **Unit 13: Mechanical and Electrical Systems (HL Only)** **Section 13.2 : Design in Practice: Mechanical Systems Application and Selection (HL only)**
IB Assessment Objectives
B3.3 How can mechanical systems be incorporated into product design?
Standards-Aligned-Daily Objectives. Instruction and assessment will align to the following objectives:
13.2 [1] Calculate mechanical advantage in gear, pulley, belt and lever systems. *B.3.3.1 Mechanical advantage of a system can be calculated.*
13.2 [2] Calculate velocity ratios for gear-, pulley- and belt-driven systems. *B.3.3.2 Velocity ratios for gear-, pulley- and belt-driven systems can be calculated.*
13.2 [3] Calculate efficiency for gear- and belt-driven systems. *B.3.3.3 Efficiency can be calculated.*
13.2 [4] Calculate gear ratios and belt-driven system ratios considering the use of drive and driven gears, calculate the speed of rotation of a gear system at several points, including initial input and final output speed, and construct systems that use gears to increase or decrease speed and motion. *B.3.3.4 Gear- and belt-driven systems are used to change the direction, speed, power and efficiency of a rotary motion.*
13.2 [5] **Analyse** how cam systems translate rotary motion into reciprocating motion, construct mechanical systems that use cams, and interpret diagrams that represent the use of cams in a system. *B.3.3.5 Cams and followers are used to change rotary motion to reciprocating motion.*
13.2 [6] **Analyse** the Load (L), Effort (E) and Fulcrum, calculate Load (L) and Effort (E), construct mechanical systems that use levers, and interpret diagrams that represent the use of levers in a system. *B.3.3.6 Levers reduce the effort needed to exert a force and move a load.*
Suggested assessment: Class Rube Goldberg Machine

IB Design Technology Year 2 **Suggested Pacing: 6 sessions**
Unit 13: Mechanical and Electrical Systems (HL Only)
Section 13.3 : Design in Theory: Introduction to Electrical Systems (HL only)

IB Assessment Objectives

A3.4 How are electronics present in everyday products?

Standards-Aligned-Daily Objectives. Instruction and assessment will align to the following objectives:

13.3 [1] **Describe** an electronic system in terms of input, process, output and feedback.
A.3.4.1 Electronic systems comprise of an input, process, output and feedback loop.

13.3 [2] **Identify** electronic products that are safe, energy-efficient and utilize minimal energy.
A.3.4.2 Electronics are ubiquitous and designers need to consider how they can be created so that they may be used responsibly in homes, industry and society as well as improving aspects of modern-day life.

13.3 [3] Distinguish between analogue and digital systems.
A.3.4.3 Electronic systems can be either analogue or digital.

13.3 [4] **Describe** analogue systems in terms of voltage, current, resistance, frequency and power using the International System of Units (SI): ampere (A), second (s), hertz (Hz), watt (W), volt (V), ohm (Ω). Students must be able to use the following SI multipliers: p, n, µ, m, k, M, G, T.
A.3.4.4 An analogue system uses continually changing signals such as sine waves.

13.3 [5] **Describe** digital systems in terms of using discrete values such as binary digits and on and off signals. Students must be able to define logic gates.
A.3.4.5 A digital system is designed to store, process and communicate information in digital form.

13.3 [6] **Explain** the purpose of passive electronic components, including fixed and variable resistors, capacitors, switches, relays and active components such as diodes and transistors.
A.3.4.6 Electronic systems are composed of electronic components that have a specific purpose.

13.3 [7] **Explain** the purpose of basic analogue and digital input electronic components, including switches and sensors (including light, temperature, humidity and sound).
A.3.4.7 Electronic systems utilize input devices to identify a change in an environment that requires a response.

13.3 [8] Compare and differentiate basic analogue and digital electronic process components, including signal conditioning (analogue) and program control (digital).
A.3.4.8 Processing devices translate an input into an output.

13.3 [9] **Describe** the use of a microcontroller as a programmable integrated circuit (PIC) into which software can be loaded to carry out a range of processing tasks.
A.3.4.9 Many everyday electronic devices contain control circuits to monitor and control.

13.3 [10] **Outline** basic analogue and digital electronic output components. Electronic output components are restricted to motors, haptic devices, buzzers, speakers, headphones, printers, lights, plotters, relays, braille display, light-emitting diode (LED) and liquid crystal display (LCD).
A.3.4.10 Electronic systems utilize output devices to perform a function in response to an initial stimulus.

13.3 [11] Compare open- and closed-loop electronic systems, **identify** where open- and closed-loop systems are used, and **explain** the purpose of feedback in a closed-loop system.
A.3.4.11 Electronic systems utilize feedback to monitor an environment and respond to a stimulus if required.

13.3 [12] **Describe** the common applications of op-amps, such as analogue or digital signal amplifiers used to amplify signals from sensors in internet of things (IoT) home appliances.
A.3.4.12 An operational amplifier (op-amp) is a high-gain voltage amplifier with differential inputs and a single output. It is one of the basic building blocks of analogue circuits.

13.3 [13] Define an embedded system, encompassing its role in augmenting everyday products' functionality, efficiency and automation.
A.3.4.13 Digital systems communicate with each other through the use of embedded systems to perform a specific task.

13.3 [14] **Identify** the symbols used in a circuit diagram for fixed and variable resistors, capacitors, switches, relays, diodes, transistors, operational amplifiers and input and output devices.
A.3.4.14 Electronic components are combined to perform a function in an electronic circuit, which is represented in a circuit diagram.

Suggested assessment: Digital Counter Display with Embedded System (Suggestion: March Madness)

IB Design Technology Year 2 **Suggested Pacing: 6 sessions** **Unit 13: Mechanical and Electrical Systems (HL Only)** **Section 13.4 : Design in Practice: Electronic Systems Application and Selection (HL only)**
IB Assessment Objectives
B3.4 How can electronic systems be incorporated into product design?
Standards-Aligned-Daily Objectives. Instruction and assessment will align to the following objectives:
13.4 [1] **Analyse** simple electronic products and circuits to identify the main component parts that enable them to perform a specific function. *B.3.4.1 Electronics are present in the design of many everyday products.*
13.4 [2] **Describe** how to use basic electronic measuring apparatus, including multi-meters, on voltage, current and resistance ranges, and oscilloscopes to observe waveforms. *B.3.4.2 Design and manufacture of electronic products requires the use of specialized apparatus.*
13.4 [3] Calculate power, voltage, current and resistance in a circuit, considering V = IR and P = VI by rearranging equations and substituting values. *B.3.4.3 Voltage (V) in a circuit is calculated by a combination of current (I) and resistance (R), and electrical power (P) is calculated by a combination of voltage (V) and current (I).*
13.4 [4] Calculate resistance and capacitance in series and parallel in a circuit. *B.3.4.4 Resistors and capacitors can be used in series or parallel in a circuit for different purposes.*
13.4 [5] Construct flow diagrams (using appropriate symbols) to model a programmable system that controls an electronic device. B.3.4.5 Electronic systems are used to perform a specific function, which can be mapped using a flow diagram.
13.4 [6] **Construct** diagrams for simple circuits that use resistors, capacitors, switches, relays, diodes, transistors, operational amplifiers, integrated circuits, and input and output devices. *B.3.4.6 System diagrams depict the components and the arrangement of circuits.*
13.4 [7] Determine the use of sensors to collect and input information into a digital system, including accelerometer (motion), ultrasonic (distance or proximity), photoresistor (light), voltage (moisture), hygrometer (humidity and air temperature), pressure (barometric), microphone (sound) and infrared (radiation or heat). *B.3.4.7 Digital systems at the first stage of the input–process–output model use inputs to sense changes in their environment.*
13.4 [8] **Construct** simple circuits that use microcontrollers as a programmable integrated circuit (PIC) with appropriate software to carry out a predetermined task. *B.3.4.8 Digital systems at the second stage of the input–process–output model use control circuits to monitor and control.*
13.4 [9] **Describe** digital systems in terms of the binary number system, Boolean algebra, logic gates such as AND, OR and NOT, combinational logic circuits and sequential logic circuits, and be able to construct truth tables for a digital circuit. *B.3.4.9 Digital systems use logic to compare input data.*
13.4 [10] Determine appropriate output devices to communicate information or physically control an environment, including motors (including servos and pumps), LCD display (communication and light), buzzer (sound) and relay (mechanical). *B.3.4.10 Digital systems at the third stage of the input–process–output model use the output to communicate to or control their environment.*
13.4 [11] Compare the protocol embedded systems used to communicate with other systems (Wi-Fi vs Bluetooth vs 5G). *B.3.4.11 Digital systems can communicate with each other using embedded systems.*
Suggested assessment: Radiant Reuse: A Sustainable Homestead Light Project

IB Design Technology Year 2 **Unit 14: Review for Exams**	**Suggested Pacing: 9 sessions**
IB Assessment Objectives	
AO1 Demonstrate knowledge of: facts, concepts, principles and terminology; design methodology, techniques and technology; methods of communicating and presenting ideas and technological information.	
AO2 Understand and apply knowledge of: facts, concepts, principles and terminology; design methodology, techniques and technology; methods of communicating and presenting ideas and technological information.	
AO3 Construct, analyse and evaluate: design briefs, problems, specifications and plans; appropriate methods, techniques, models and products; data, information and technological explanations.	

NJSLS Career Awareness, Exploration, Preparation, and Training, and Life Literacies and Key Skills	
9.2.12.CAP.1	Analyze unemployment rates for workers with different levels of education and how the economic, social, and political conditions of a time period are affected by a recession.
9.2.12.CAP.2	Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
9.2.12.CAP.4	Evaluate different careers and develop various plans (e.g. costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
9.2.12.CAP.5	Assess and modify a personal plan to support current interests and postsecondary plans.
9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.
9.2.12.CAP.7	Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements in areas of career interest.
9.2.12.CAP.8	Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
9.2.12.CAP.9	Locate information on working papers, what is required to obtain them, and who must sign them.
9.2.12.CAP.10	Identify strategies for reducing overall costs of postsecondary education (e.g., tuition assistance, loans, grants, scholarships, and student loans).
9.2.12.CAP.11	Demonstrate an understanding of Free Application for Federal Student Aid (FAFSA) requirements to apply for postsecondary education
9.2.12.CAP.11*	Explain how compulsory government programs (e.g., Social Security, Medicare) provide insurance against some loss of income and benefits to eligible recipients.
9.2.12.CAP.12	Analyze how the economic, social, and political conditions of a time period can affect the labor market.
9.2.12.CAP.13	Analyze and critique various sources of income and available resources (e.g., financial assets, property, and transfer payments) and how they may substitute for earned income.
9.2.12.CAP.14	Demonstrate how exemptions, deductions, and deferred income (e.g. retirement or medical) can reduce taxable income.
9.2.12.CAP.15	Explain why taxes are withheld from income and the relationship of federal, state, and local taxes (e.g. property, income, excise, and sales) and how the money collected is used by local, county, state, and federal governments.
9.2.12.CAP.16	Analyze the impact of the collective bargaining process on benefits, income, and fair labor practice.
9.2.12.CAP.17	Differentiate between taxable and nontaxable income from various forms of employment (e.g. cash business, tips, tax filing and withholding).
9.2.12.CAP.18	Explain the purpose of payroll deductions and why fees for various benefits (e.g., medical benefits) are taken out of pay, including the cost of employee benefits to employers and self-employment income.

9.2.12.CAP.19	Analyze a Federal and State Income Tax Return.
9.2.12.CAP.20	Explain low-cost and low-risk ways to start a business.
9.2.12.CAP.21	Compare risk and reward potential and use the comparison to decide whether starting a business is feasible.
9.2.12.CAP.22	Identify different ways to obtain capital for starting a business.
9.4.12.CI.1	Demonstrate the ability to reflect, analyze and use creative skills and ideas.
9.4.12.CI.2	Identify career pathways that highlight personal talents, skills and abilities.
9.4.12.CI.3	Investigate new challenges and opportunities for personal growth, advancement and transition
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice.
9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving.
9.4.12.CT.3	Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why solutions may work better than others (e.g., political. economic, cultural).
9.4.12.CT.4	Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g., environmental justice).
9.4.12.CT.5	Participate in online strategy and planning sessions for course-based, school-based or other project and determine the strategies that contribute to effective outcomes.
9.4.12.DC.1	Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content.
9.4.12.DC.2	Compare and contrast international differences in copyright laws and ethics.
9.4.12.DC.3	Evaluate the social and economic implications of privacy in the context of safety, law, or ethics.
9.4.12.DC.4	Explain the privacy concerns related to the collection of data (e.g. cookies) and generation of data through automated processes that may not be evident to users.
9.4.12.DC.5	Debate laws and regulations that impact the development and use of software.
9.4.12.DC.6	Select information to post online that positively impacts personal image and future college and career opportunities.
9.4.12.DC.7	Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society.
9.4.12.DC.8	Explain how increased network connectivity and computing capabilities of everyday objects allow for innovative technological approaches to climate protection.
9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities and utility for accomplishing a specified task
9.4.12.TL.2	Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
9.4.12.TL.3	Analyze the effectiveness of the process and quality of collaborative environments.
9.4.12.TL.4	Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.
9.4.12.GCA.1	Collaborate with individuals analyze a variety of potential solutions to climate change effects and determine why solutions may work better than others (e.g., political. economic, cultural).
9.4.12.IML.1	Compare search browsers and recognize features that allow for filtering of information.
9.4.12.IML.2	Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.
9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
9.4.12.IML.4	Assess and critique the appropriateness and impact of existing data visualizations for an intended audience.

9.4.12.IML.5	Evaluate, synthesize and apply information on climate change from various sources appropriately.
9.4.12.IML.6	Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender and age diversity.
9.4.12.IML.7	Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change.
9.4.12.IML.9	Evaluate media sources for point of view, bias and motivations.
9.4.12.IML.10	Analyze the decisions creators make to reveal explicit and implicit messages within information and media.

* ID 9.2.12.CAP.11 duplicated in NJDOE NJSLS file page 1 and 2