

Course Title: Robotics 2a/2b

State: TX
State Course Title: Robotics 2
State Course Code: 130.409
State Standards: Essential Knowledge and Skills for Career and Technical Education
Date of Standards: August 2017

TEKS	Course Title. (a or b), if applicable, e.g. Game Design 1a	Unit Name(s)	Lesson(s) Numbers
1. The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:			
(A) distinguish the differences among an engineering technician, engineering technologist, and engineer;	Robotics 2a	Unit 1: Objects in Space	Lesson 4
(B) identify employment and career opportunities;	Robotics 2b	Unit 8: Presenting Your Robot	Lesson 4
(C) identify industry certifications;	Robotics 2b	Unit 8: Presenting Your Robot	Lesson 4
(D) recognize the principles of teamwork related to engineering and technology;	Robotics 2a	Unit 7: Working Together	Lesson 4
(E) identify and use appropriate work habits;	Robotics 2a	Unit 7: Working Together	Lesson 4
(F) locate and report on governmental regulations and laws, including health, safety, and	Robotics 2b	Unit 1: Robot Safety	Lesson 2
(G) discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects;	Robotics 2a	Unit 7: Working Together	Lesson 4
(H) demonstrate respect for diversity in the workplace;	Robotics 2a	Unit 7: Working Together	Lesson 4
(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality;	Robotics 2a	Unit 4: Really Smart Robots	Lesson 4
(J) demonstrate effective oral and written communication skills using a variety of software applications and media; and	Robotics 2a	Unit 6: Presenting Your Solution	Lesson 3

(K) explore robotic engineering careers and preparation programs	Robotics 2b	Unit 8: Presenting Your Robot	Lesson 4
2. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:			
(A) apply mathematics to problems arising in everyday life, society, and the workplace;	Robotics 2a	Unit 5: The Design Process	Lesson 3
(B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;	Robotics 2a	Unit 5: The Design Process	Lesson 1
(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;	Robotics 2a	Unit 5: The Design Process	Lesson 2
(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	Robotics 2a	Unit 5: The Design Process	Lesson 4
(E) create and use representations to organize, record, and communicate mathematical ideas;	Robotics 2a	Unit 5: The Design Process	Lesson 3
(F) analyze mathematical relationships to connect and communicate mathematical ideas; and	Robotics 2a	Unit 5: The Design Process	Lesson 3
(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.	Robotics 2a	Unit 5: The Design Process	Lesson 3
3. The student learns and contributes productively as an individual and as a member of a project team. The student is expected to:			
(A) demonstrate an understanding of and discuss how teams function;	Robotics 2a	Unit 7: Working Together	Lesson 4
(B) apply teamwork to solve problems;	Robotics 2a	Unit 7: Working Together	Lesson 4
(C) follow directions and decisions of responsible individuals of the project team;	Robotics 2a	Unit 7: Working Together	Lesson 4
(D) participate in establishing team procedures and team norms; and	Robotics 2a	Unit 7: Working Together	Lesson 4
(E) work cooperatively with others to set and accomplish goals in both competitive and noncompetitive situations.	Robotics 2a	Unit 7: Working Together	Lesson 2

4. The student develops skills of project management. The student is expected to:			
(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project;	Robotics 2a	Unit 6: Presenting Your Solution	Lesson 2
(B) develop a project schedule and complete work according to established criteria;	Robotics 2a	Unit 7: Working Together	Lesson 2
(C) participate in the organization and operation of a real or simulated engineering project; and	Robotics 2a	Unit 7: Working Together	Lesson 3
(D) translate and employ a Project Management Plan for production of a product.	Robotics 2a	Unit 7: Working Together	Lesson 1
5. The student practices safe and proper work habits. The student is expected to:			
(A) master relevant safety tests;	Robotics 2b	Unit 1: Robot Safety	Lesson 1
(B) comply with safety guidelines as described in various manuals, instructions, and regulations;	Robotics 2b	Unit 1: Robot Safety	Lesson 2
(C) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations;	Robotics 2b	Unit 1: Robot Safety	Lesson 4
(D) dispose of hazardous materials and wastes appropriately;	Robotics 2b	Unit 1: Robot Safety	Lesson 4
(E) comply with established guidelines for working in a lab environment;	Robotics 2b	Unit 1: Robot Safety	Lesson 2
(F) handle and store tools and materials correctly;	Robotics 2b	Unit 1: Robot Safety	Lesson 2
(G) employ established inventory control and organization procedures; and	Robotics 2b	Unit 1: Robot Safety	Lesson 1
(H) describe the results of negligent or improper maintenance.	Robotics 2b	Unit 1: Robot Safety	Lesson 3
6. The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:			
(A) demonstrate the use of computers to manipulate a robotic or automated system and associated subsystems;	Robotics 2a	Unit 3: On the Assembly Line	Lesson 1

(B) troubleshoot and maintain systems and subsystems to ensure safe and proper function and precision operation;	Robotics 2a	Unit 3: On the Assembly Line	Lesson 1
(C) implement feedback control loops used to provide information; and	Robotics 2a	Unit 5: The Design Process	Lesson 3
(D) implement different types of sensors used in robotic or automated systems and their operations.	Robotics 2b	Unit 2: Sensors and Specialized Applications	Lesson 2
7. The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:			
(A) apply the concepts of acceleration and velocity as they relate to robotic and automated systems;	Robotics 2a	Unit 3: On the Assembly Line	Lesson 3
(B) describe the term degrees of freedom and apply it to the design of joints used in robotic and automated systems;	Robotics 2a	Unit 3: On the Assembly Line	Lesson 2
(C) describe angular momentum and integrate it in the design of robotic joint motion, stability, and mobility;	Robotics 2a	Unit 3: On the Assembly Line	Lesson 2
(D) use the impulse-momentum theory in the design of robotic and automated systems;	Robotics 2a	Unit 3: On the Assembly Line	Lesson 3
(E) explain translational, rotational, and oscillatory motion in the design of robotic and automated systems;	Robotics 2a	Unit 3: On the Assembly Line	Lesson 4
(F) apply the operation of direct current (DC) motors, including control, speed, and torque;	Robotics 2a	Unit 3: On the Assembly Line	Lesson 2
(G) apply the operation of servo motors, including control, angle, and torque;	Robotics 2a	Unit 3: On the Assembly Line	Lesson 2
(H) interpret sensor feedback and calculate threshold values;	Robotics 2a	Unit 3: On the Assembly Line	Lesson 4
(I) apply measurement and geometry to calculate robot navigation;	Robotics 2a	Unit 3: On the Assembly Line	Lesson 4
(J) implement movement control using encoders; and	Robotics 2a	Unit 3: On the Assembly Line	Lesson 2
(K) implement path planning using geometry and multiple sensor feedback.	Robotics 2a	Unit 3: On the Assembly Line	Lesson 4
8. The student creates a program to control a robotic or automated system. The student is expected to:			

(A) use coding languages and proper syntax;	Robotics 2b	Unit 5: Improving Your Design	Lesson 2
(B) use programming best practices for commenting and documentation;	Robotics 2b	Unit 4: Programming Your Robot	Lesson 4
(C) describe how and why logic is used to control the flow of the program;	Robotics 2b	Unit 4: Programming Your Robot	Lesson 3
(D) create a program flowchart and write the pseudocode for a program to perform an operation;	Robotics 2b	Unit 4: Programming Your Robot	Lesson 4
(E) create algorithms for evaluating a condition and performing an appropriate action using decisions;	Robotics 2b	Unit 4: Programming Your Robot	Lesson 3
(F) create algorithms that loop through a series of actions for a specified increment and for as long as a given condition exists;	Robotics 2b	Unit 4: Programming Your Robot	Lesson 3
(G) create algorithms that evaluate sensor data as variables to provide feedback control;	Robotics 2b	Unit 4: Programming Your Robot	Lesson 3
(H) use output commands and variables;	Robotics 2b	Unit 5: Improving Your Design	Lesson 4
(I) use selection programming structures such as jumps, loops, switch, and case; and	Robotics 2b	Unit 4: Programming Your Robot	Lesson 3
(J) implement subroutines and functions.	Robotics 2b	Unit 5: Improving Your Design	Lesson 4
9. The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:			
(A) demonstrate knowledge of robotic or automated system arm construction;	Robotics 2b	Unit 6: Heavy Lifting	Lesson 1
(B) demonstrate an understanding and apply the concepts of torque, gear ratio, stability, and weight of payload in a robotic or automated system arm operation; and	Robotics 2b	Unit 6: Heavy Lifting	Lesson 1
(C) demonstrate an understanding and apply the concepts of linkages and gearing in end effectors and their use in a robotic or an automated arm system	Robotics 2b	Unit 6: Heavy Lifting	Lesson 1
10. The student uses engineering design methodologies. The student is expected to:			
(A) implement the design process;	Robotics 2a	Unit 6: Presenting Your Solution	Lesson 1

(B) demonstrate critical thinking, identify the system constraints, and make fact-based decisions;	Robotics 2a	Unit 6: Presenting Your Solution	Lesson 2
(C) apply formal testing and reiteration strategies to develop or improve a product;	Robotics 2b	Unit 7: Test and Evaluate Your Robot	Lesson 3
(D) apply and defend decision-making strategies when developing solutions;	Robotics 2a	Unit 6: Presenting Your Solution	Lesson 2
(E) identify and improve quality-control issues in engineering design and production;	Robotics 2b	Unit 7: Test and Evaluate Your Robot	Lesson 4
(F) apply Six Sigma to analyze the quality of products and how it affects engineering decisions;	Robotics 2b	Unit 7: Test and Evaluate Your Robot	Lesson 4
(G) use an engineering notebook to document the project design process as a legal document; and	Robotics 2a	Unit 6: Presenting Your Solution	Lesson 1
(H) create and interpret industry standard system schematics.	Robotics 2a	Unit 6: Presenting Your Solution	Lesson 4
11. The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:			
(A) use and maintain tools and laboratory equipment in a safe manner to construct and repair systems;	Robotics 2a	Unit 8: Prototype Your Robot	Lesson 4
(B) use precision measuring instruments to analyze systems and prototypes;	Robotics 2a	Unit 8: Prototype Your Robot	Lesson 4
(C) implement a system to identify and track all components of the robotic or automated system and all elements involved with the operation, construction, and manipulative functions; and	Robotics 2a	Unit 8: Prototype Your Robot	Lesson 4
(D) use multiple software applications to simulate robot behavior and present concepts.	Robotics 2b	Unit 6: Heavy Lifting	Lesson 4
12. The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:			
(A) use the design process to design a robotic or automated system that meets pre-established criteria and constraints;	Robotics 2a	Unit 6: Presenting Your Solution	Lesson 2
(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype;	Robotics 2a	Unit 8: Prototype Your Robot	Lesson 3
(C) implement sensors in the robotic or automated system;	Robotics 2a	Unit 8: Prototype Your Robot	Lessons 1-4

(D) construct the robotic or automated system;	Robotics 2a	Unit 8: Prototype Your Robot	Lessons 1-4
(E) use the design process to evaluate and formally test the design;	Robotics 2b	Unit 7: Test and Evaluate Your Robot	Lesson 2
(F) refine the design of the robotic or automated system to ensure quality, efficiency, and manufacturability of the final robotic or automated system; and	Robotics 2b	Unit 2: Sensors and Specialized Applications	Lesson 1
(G) present the final product using a variety of media.	Robotics 2b	Unit 8: Presenting Your Robot	Lesson 3