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Scope & Sequence

Course Name: Robotics I **TSDS PEIMS Code:** 13037000		**Course Credit:** 1.0 **Course Requirements:** Recommended for students in Grades 9-10. **Prerequisites:** None. **Recommended Prerequisite:** Principles of Applied Engineering.
Course Description: In Robotics I, students will transfer academic skills to component designs in a project-based environment through implementation of the design process. Students will build prototypes or use simulation software to test their designs. Additionally, students will explore career opportunities, employer expectations, and educational needs in the robotic and automation industry.		
NOTE: This is a suggested scope and sequence for the course content. This content will work with any textbook or instructional materials. If locally adapted, make sure all TEKS are covered.		
Total Number of Periods **Total Number of Hours**	175 Periods 131.25 Hours	Scope and sequence allows additional time for guest speakers, student presentations, field trips, remediation, extended learning activities, etc.
Unit Number, Title, and Brief Description	**# of Class Periods*** (assumes 45-minute periods) Total minutes per unit	**TEKS Covered** **130.408. (c) Knowledge and skills**
Unit 1: Science, Technology, Engineering, and Mathematics (STEM) Robotics Overview This Science, Technology, Engineering, and Mathematics (STEM) Robotics Overview unit is designed to give students the opportunity to explore training, education, and career opportunities. Students will investigate and create a plan to achieve industry certifications. Upon culmination of the unit, students will discuss ethical issues related to robotics and incorporating proper ethics in submitted projects, as well as identify appropriate actions and consequences relating to discrimination, harassment, and inequality.	15 Periods 675 Minutes	(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to: (A) distinguish the differences among an engineering technician, engineering technologist, and engineer; (B) identify employment and career opportunities; (C) identify industry certifications; (D) discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects; (E) identify and demonstrate respect for diversity in the workplace; (F) identify appropriate actions and consequences relating to discrimination, harassment, and inequality.

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Unit 2: Science, Technology, Engineering, and Mathematics (STEM) Robotics Exploration In this unit, students will explore careers and preparation programs in robotics. Upon culmination of the unit, students will submit findings about career preparation, including job shadowing, mentoring, and apprenticeship training.	15 Periods 675 Minutes	(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to: (G) explore electronics career and preparation programs; (H) explore career preparation learning experiences, including, but not limited to, job shadowing, mentoring, and apprenticeship training; and (I) discuss *Accreditation Board for Engineering and Technology* (ABET) accreditation and implications.
Unit 3: Safety Precautions This unit offers students the opportunity to demonstrate basic technical skills necessary for safety precautions in the STEM field. Students will adhere to and follow all guidelines and regulations to maintain a safe working environment. The culminating activity will have students describe the results of negligent or improper maintenance of tools, equipment, and machines.	10 Periods 450 Minutes	(5) The student practices safe and proper work habits. The student is expected to: (A) master relevant safety tests; (B) comply with safety guidelines as described in various manuals, instructions, and regulations; (C) identify governmental and organizational regulations for health and safety in the workplace related to electronics; (D) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations; (E) dispose of hazardous materials and wastes appropriately; (F) perform maintenance on selected tools, equipment, and machines; (G) handle and store tools and materials correctly; and (H) describe the results of improper maintenance of material, tools, and equipment.
Unit 4: Teamwork in STEM In this unit students will apply principles of problem solving through collaboration and conflict resolution. Students will use positive attitudes to demonstrate effective teamwork. The culminating activity will be for the students to identify and demonstrate the proper attitude found in team leaders in the field of robotics.	15 Periods 675 Minutes	(3) The student participates in team projects in various roles. The student is expected to: (A) explain the importance of teamwork in the field of robotics; (B) apply principles of effective problem solving in teams to collaboration and conflict resolution; and (C) demonstrate proper attitudes as a team leader and team member.
Unit 5: Project Management In this unit, students will develop a project management plan	15 Periods 675 Minutes	(4) The student develops skills for managing a project. The student is expected to: (A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project;

including initiating, executing, monitoring, controlling, and closing a real or simulated project. The culminating activity will have students develop and present a production plan for an individual project.			(B) develop a project schedule and complete work according to established criteria; (C) participate in the organization and operation of a real or simulated engineering project; and (D) develop a plan for production of an individual product.
Unit 6: Employability Skills This unit offers students basic technical skills necessary to fulfill careers in the workforce. Through group activities, students will demonstrate interpersonal skills, such as: communication, professionalism, decision-making, leadership, and conflict resolution. The unit culminates with a peer review evaluation and reflection upon skills needed for success in the workforce.	15 Periods 675 Minutes	(1)	The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to: (A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession; (B) demonstrate the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome; (C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions; (D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results; and (E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed.
Unit 7: Time for Project Based Learning The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services. In this unit, students will use tools and laboratory equipment in a safe manner to construct and repair system and use precision measuring instruments to analyze systems and prototypes. The culminating activity for this unit will be for students to use multiple software applications to simulate robot behavior and present concepts.	15 Periods 675 Minutes	(10)	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 tools and laboratory equipment in a safe manner to construct and repair systems; (B) use precision measuring instruments to analyze systems and prototypes; and (C) use multiple software applications to simulate robot behavior and present concepts.
Unit 8: Engineering Principles and Fundamental Physics	15 Periods 675 Minutes	(7)	The student develops an understanding of engineering principles and fundamental physics. The student is expected to:

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In this unit, students will perform functions to demonstrate knowledge of Newton's Law as it applies to robotics and demonstrate knowledge of motors and gears as used in robotic systems. The culminating activity will include students describing the application of the simple machines to robotics.			(A) demonstrate knowledge of Newton's Laws as applied to robotics such as rotational dynamics, torque, weight, friction, and traction factors required for the operation of robotic systems; (B) demonstrate knowledge of motors, gears, gear ratios, and gear trains used in the robotic systems; (C) describe the application of the six simple machines to robotics; (D) describe the operation of direct current (DC) motors, including control, speed, and torque; and (E) describe the operation of servo motors, including control, angle, and torque.
Unit 9: Components Required for Robotic Functions Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions. In this unit, students will describe the workings of a robotic arm. The culminating activity will have students describe the relationship between torque and gear ratio to payload in robotic arm operations.	15 Periods 675 Minutes	(8)	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) describe the relationship between robotic arm construction and robot stability; (B) describe the relationship between torque and gear ratio to weight of payload in a robotic arm operation; and (C) demonstrate knowledge of linkages and gearing in end effectors used in a robotic arm system.
Unit 10: Maintain Technological Products, Processes, and Systems In this unit, students will demonstrate principles of project documentation and workflow to simulated and actual work situations. The culminating activity will include having students read and interpret technical drawings, manuals, and bulletins.	15 Periods 675 Minutes	(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; (B) maintain systems to ensure safe and proper function and precision operation; (C) describe feedback control loops used to provide information; and (D) describe types and functions of sensors used in robotic systems.
Unit 11: Design Methodologies In this unit, students will perform such functions such as apply testing and reiteration strategies to develop or improve a product and apply decision-making strategies when developing solutions.	15 Periods 675 Minutes	(9)	The student uses engineering design methodologies. The student is expected to: (A) demonstrate an understanding of and discuss the design process; (B) think critically, identify the system constraints, and make fact-based decisions;

Students will use an engineering notebook to document the project design process as a legal document.			(C) apply testing and reiteration strategies to develop or improve a product; (D) apply decision-making strategies when developing solutions; (E) identify quality-control issues in engineering design and production; (F) describe perceptions of the quality of products and how they affect engineering decisions; (G) use an engineering notebook to document the project design process as a legal document; and (H) interpret industry standard system schematics.
Unit 12: Extended Learning Experience During this unit students will build a prototype circuit. In this unit, students are encouraged to expand their learning experiences through avenues such as STEM organizations and other leadership or extracurricular organizations. By connecting with these networks and/or their peers in the previous unit, students will present their final project which may lead to future career opportunities.	15 Periods 675 Minutes	(11)	The student produces a product using the appropriate tools, materials, and techniques. The student is expected to: (A) identify and describe the steps needed to produce a prototype; (B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype; (C) construct a robotic or automated system to perform specified operations using the design process; (D) test and evaluate the design in relation to pre-established requirements such as criteria and constraints; (E) refine the design of a robotic or automated system to ensure quality, efficiency, and manufacturability of the final product; and (F) present the final product using a variety of media.